4.0 NATIONAL TECHNICAL REVIEW COMMITTEE COMMENTS

This section presents comments of the National Technical Review Committee (NTRC), which provided external, independent technical review of the LCA Study. The purpose of the NTRC was to ensure quality and credibility of the results of the planning process. Comments from the NTRC follow.

4.1 SUMMARY COMMENTS

4.1.1 Science & Technology Appendix Comments

NTRC-01: The Science Board should not include agency personnel in the capacity of representing their agencies, but they could serve as liaisons or ex-officio members. Agency scientists should be able to serve as members of the SB based on expertise.

Response: Agency personnel will be allowed to serve on the SB as technical experts, but will not represent agency positions on regulations, policy, or guidance. If information on these subjects is needed regarding science issues, the SB will request official communication on these issues.

NTRC-02: Members of the NTRC endorse the idea of the formation of ad hoc peer review committees but recommend that these committees should be focused and term-limited.

Response: Concur. Formation of ad hoc peer review committees should be limited to a specific task and time-period.

***NTRC-03*:** Although funding for the S&TP will come from both State and Federal sources, there should be a unified program with funding of scientific studies based on identified needs of the LCA program and competitive grants.

Response: Concur. The PM already makes decisions for allocation of combined funding to program activities, and will continue to do so for the LCA.

NTRC-04: Members of the NTRC support the idea that the S&T office should be housed outside of State (e.g., LDNR) and Federal (e.g., COE, USGS) agencies, potentially in association with a major research organization.

Response: Comment noted

***NTRC-05**:* Science projects should be interdisciplinary and inter-institutional and should be awarded on a competitive basis. Scientists participating in the science effort should be expected to both provide results in a form usable by the LCA team and to publish results in peer-reviewed scientific journals. But there should be a simple structure without cumbersome reporting lines and vague responsibilities.

Response: Comment noted. Policies will be formulated for all aspects of the S&T program after a Director is selected. Funding for S&T research will be awarded in a manner consistent with policies set up in the Program.

***NTRC-06**:* The organization and staffing structure of the S & T office should be sufficient to manage the workload associated with ongoing and planned LCA activities.

Response: Comment noted.

***NTRC-07**:* Members of the NTRC support the strategy in the S&T Plan that Information Technology (web site, metadata development, QA & QC of data streams from individual projects, meeting federal requirements for reporting, etc.) be an important component of the S&T office to insure uniformity and communication across the entire LCA effort.

***Response**:* Comment noted.

***NTRC-08**:* The Director of the S&T Office is a key person, who would not only be responsible for determining S&T priorities, peer review, contracting and reporting, but must also provide leadership for the incorporation of science and technology into the adaptively managed LCA program. Therefore, a broad search should be conducted to find the best person available regardless of present institutional affiliation.

***Response**:* Comment noted.

4.1.2 Recommendations for Comprehensive Planning and Adaptive Management

***NTRC-09**:* The directive to select a few specific projects to be authorized for short-term implementation has provided some difficult constraints in developing a comprehensive approach to LCA restoration. Given those constraints, the decision process and associated screening criteria represent a reasonable approach to identifying near-term critical restoration features that are important elements of a more comprehensive framework, provide learning opportunities consistent with adaptive management and could feasibly be completed within 10 years. However, justification for project selection is weak or unclear; the appearance is that some projects were chosen for reasons other than those supported by LCA Plan goals and then rationalized.

Response: The explanation of the selection process in the Main Report has been rewritten to more fully explain how items were selected. All potential elements meet program objectives.

NTRC-10: Placement of the adaptive management (AM) program discussion in the S&T appendix suggests a reduced level of importance of this key element of the LCA Study. It is recommended that the discussion of the AM program management should be removed from Appendix A (S&T office) and fully integrated in the Main Report.

Response: The Main Report presents the Plan in a succinct manner while emphasizing the AEAM will be an integral component for effective program management. Details are presented in the Appendices.

NTRC-11: A concise (but sufficiently detailed) description of overall decision support system needs to be the first section of the main report and explained in a way that makes AM the centerpiece of that decision support system.

Response: The Main Report has been revised to provide a more complete description of the role and functions of the decision support system for implementation of the LCA. This information is included in the sections that detail program management, so that an introduction and statement of the problem can be explained at the beginning of the report.

NTRC-12: The discussion of the decision support system in the main report should make clear that it would be developed to explicitly identify constraints and tradeoffs among new projects, existing and backlogged projects and other planning and regulatory decisions made that affect the flow of service from the working coast.

Response: The role of the decision support system in program management has been clarified in the Main Report.

***NTRC-13**:* The main report should clarify that the decision support for the LCA will be accomplished through the development of the "systems synthesis model" (there is a discussion of such a model in the S&T draft). The basic features of that model, its utilization and its improvement through time should be described in the main report.

Response: Concur. The text has been revised to explain the use of the systems synthesis model to support decision making.

***NTRC-14**:* A system syntheses modeling and planning "center of expertise" should be housed within the program management office, while the responsibility for model development should be in the office of the S&T. There should be a system synthesis capability located at the interface with decision making, although there is some reference to that concept in the S&T appendix.

Response: PM is not an office it is a function. Each element of the LCA team supports PM. The S&T Office would develop, maintain and manage the model and PET would use and provide feedback for model refinement.

***NTRC-15**:* The term "Adaptive Management" is insufficiently explained, is at times misleading, and AM discussion text should be edited to remedy these deficiencies.

Response: The Report has been amended for clarity regarding adaptive management.

***NTRC-16**:* The report should define the term "best science" in the context of the AM framework and the modeling required to build a better decision support system over time.

Response: The appendix has been revised to clarify that determinations of "Best science" will be made using evidence-based approaches that consider uncertainties, sensitivities and importance of information in decisions made for the Program.

***NTRC-17**:* The text should be carefully edited to clarify the roles for monitoring in an AM planning framework, and within the S&T program.

Response: The role of monitoring in adaptive management is clearly defined in Appendix A. Coast wide monitoring efforts are currently underway. Additional monitoring needs identified by the Program will be coordinated with ongoing efforts.

NTRC-18: The LCA Team needs to develop a comprehensive plan that establishes a planning framework suited to the spatial and temporal scales of the LCA program, including internal guidance for future system-scale studies

Response: Comment noted. Comprehensive planning will be addressed in the Master Program Management Plan, which will be developed following Congressional approval of the LCA TSP.

4.1.3 Near Term and Demonstration Projects

NTRC-19: The case for the MRGO environmental restoration features is considerably weakened by the failure of the Report to address in a forthright way the decision process and timeframe in which the future of the MRGO will be determined. This leads, with some justification, to the suspicion that stabilization of the existing land features, at a minimum puts off decisions regarding the fate of MRGO. The final Report should clearly indicate how undertaking these features will factor into decisions on the use of MRGO for navigation and the long-term management options for the channel and associated dredged material banks.

Response: The report has been revised to reflect these concerns.

NTRC-20: It should be demonstrated that the Hope Canal diversion will deliver enough sediment or promote productivity yielding habitat that dries periodically. A long-term management plan for the swamp should be developed in conjunction with the project.

Response: Concur. The project specific feasibility-level document will fully develop the design, monitoring, operation, and management of this feature.

NTRC-21: The plan for the Barataria Basin barrier shoreline restoration, including Caminada Headland and Shell Island reaches, as proposed will require maintenance in perpetuity; while this may be an acceptable option, the need for perpetual maintenance should be acknowledged and innovative methods should be developed to control costs of ongoing maintenance. These features call for pumping of sediment “from interior open-water sites” (page MR-167). The NTRC recommends that the plan carefully considers how removal of sediment from interior open-water sites will impact interior marshes, because this process could accelerate interior land loss and/or decrease habitat value.

Response: The report has been revised to reflect utilization of resources from outside the system.

NTRC-22: The proposed Bayou Lafourche feature represents a good example of leveraging efforts under CWPPRA to advance the goals of the LCA Ecosystem Restoration Study. However, several key components of the feature are omitted and, therefore make assessment more difficult. The narrative should include information about the proposed quantity of water that constitutes a “small” reintroduction. It should also discuss how the added water volumes will be handled. The project should include more detailed discussion about how benefits were calculated. There should be additional information to comprehensively assess the effectiveness of this proposed feature.

Response: Concur. The Main Report has been revised to provide additional information on the basis for the size category determinations for diversion features, water management procedures and benefit calculation methods.

NTRC-23: This Myrtle Grove project offers excellent opportunities for both significant benefits to Subprovince 2 and learning how to manage dredged material and river diversions in tandem. This project should be integrated with the Davis Pond and Bayou Lafourche projects.

Response: Concur. Analyses would be performed to determine the optimum size and location of each feature and then separate decision documents will be prepared for each project. The cumulative effects will be considered and evaluated in the design and operation of these features.

4.1.4 Science and Technology Program Demonstration Projects

NTRC-24: This is a very important component of the LCA Plan because it provides the opportunity for large-scale experiments to rapidly improve learning in an adaptive management context. The challenge, however, is to provide sufficient flexibility to pursue strategic challenges and substitute different objectives in order to reduce uncertainty.

Response: Comment noted.

NTRC-25*:* The marsh restoration and/or creation using saline sediments project needs to be reconsidered and revised.

Response: Descriptions of all demonstration projects have been revised. However, all are presented as examples. The S&T Program will determine the final selection of Demonstration Projects.

NTRC-26*:* NTRC members support the proposed land bridge restoration project using long-distance conveyance of sediments but the specific location to demonstrate this technology should be justified.

Response: Specific locations have been removed from the descriptions of the types of demonstration projects. The S&T Program will determine the location of Demonstration Projects.

NTRC-27*:* The pipeline canal restoration project needs to be revised to take advantage of and build upon past work on backfilling of pipeline canals.

Response: See response to comment NTRC-25.

NTRC-28*:* The shoreline erosion prevention project should be integrated with other planned projects that require use of shoreline armoring.

Response: See response to comment NTRC-25.

NTRC-29*:* For the barrier island restoration project, it has not been demonstrated that a full-scale demonstration project is required to reduce key uncertainties.

Response: See response to comment NTRC-25.

4.1.5 Programmatic Authorities

NTRC-30: Members of the NTRC strongly support the proposed use of programmatic authority to support beneficial use of dredged material and modifications of existing structures.

Response: Comment noted.

4.1.6 Large-scale and Long-term Concepts Requiring Detailed Study

NTRC-31: NTRC members want to again emphasize that future efforts need to continuously evaluate and update projects that fall into the category of long-term and large-scale.

Response: Text has been added to discuss the Large-Scale and Long-Term Concepts Requiring Detailed Study.

NTRC-32: Uncertainties should be clearly identified in each of the large-scale and long-term projects so that direction and guidelines can be developed to move them forward within the planning process. Consideration needs to be given to the relationships between the proposed large-scale and long-term projects and smaller scale and shorter-term projects that are planned and implemented.

Response: Text has been added to discuss the Large-Scale and Long-Term Concepts Requiring Detailed Study. Some projects (i.e. Northern Barataria Basin, California Bay Diversion, Fort Jackson Diversion) have been deferred pending resolution of large-scale and long-term concepts requiring additional studies.

NTRC-33: A significant concern, expressed initially at the April, 2004 NTRC Meeting, is whether these potentially important components of the comprehensive restoration plan will disappear from the radar screen altogether. In short, it is not clear how momentum will be generated to keep the long-term studies alive as viable options, and we specifically recommend that this be addressed more fully in the LCA Plan Implementation.

Response: The Large-Scale and Long-Term Concepts Requiring Detailed Study are included in the recommendation. If the studies determine that the concepts are viable, they may be used to develop specific projects.

***NTRC-34**:* The Mississippi River Hydrodynamic Model should be entitled Mississippi and Atchafalaya Rivers Hydrodynamic and Sediment Impact Assessment Model and appropriate changes made in the report.

Response: The Atchafalaya and Mississippi Rivers are located in the area encompassed by the Mississippi River Hydrodynamic Model. Descriptions of all long-term large-scale studies have been revised.

***NTRC-35**:* Members again want to recommend that the plan for the Chenier Plain must be elevated to the status of the other three subprovinces in terms of innovation, commitment and approach and that planning needs to shift from a primary emphasis on water management to projects that take advantage of nearshore sediments and natural dispersal processes to reverse the pattern of wetland loss.

Response: The Cheiner Plain Freshwater and Sediment Management and Allocation Study will provide the background information needed to develop the best plan for restoration of subprovince four.

***NTRC-36**:* NTRC members recommend that it should be demonstrated that the Acadiana Bay project does not alter hydrology in this area in a way that has a negative impact on delta growth.

Response: Comment noted.

4.2 DETAILED COMMENTS

4.2.1 Science and Technology Program

***NTRC-37**:* NTRC members strongly support the establishment of a Science Board (SB) to review and comment upon the study, selection, sequence, and operation of restoration projects, the criteria used to select, sequence and operate projects, the comprehensive restoration plan, and the extent to which project construction and operations comply with the goals of the comprehensive restoration plan.

Response: Comment noted.

NTRC-38*:* This SB should include nationally recognized experts such as biologists, geologists, hydrologists, engineers, river geomorphologists and other recognized experts in coastal and riverine ecosystem restoration. The SB should not include agency personnel in the capacity of representing their agencies, but agency representatives can serve as liaisons or ex-officio members. Agency scientists should be able to serve as members of the SB based solely on expertise.

Response: The SB would include a wide range of technical experts. See response to comment NTRC-01 for additional information on SB member roles.

NTRC-39*:* NTRC members endorse the idea of the formation of ad hoc peer review committees but recommend that these committees should be focused and term-limited.

Response: See response to comment NTRC-02.

NTRC-40*:* Although funding for the S&TP will come from both State and Federal sources, there should be a unified program with funding of scientific studies based on identified needs of the LCA program and competitive grants.

Response: See response to comment NTRC-03 and NTRC-05.

NTRC-41*:* It is a premise that throughout the LCA program, adaptive management should be an integral part of the entire LCA program and not just the S&T.

Response: Concur.

NTRC-42*:* NTRC members support the idea that the S&T office should be housed outside of State (e.g., LDNR) and Federal (e.g., COE, USGS) agencies at a major university or research organization. This would give the science effort a strong degree of independence while still being strongly collaborative and responsive to (but not subservient to) Federal and State agencies. Even though the Science Office will be in a single location, it should be a consortium that incorporates the expertise of the entire scientific research community. Science projects should be interdisciplinary and inter-institutional and should be awarded on a competitive basis. Scientists participating in the science effort should be expected to both provide results in a form usable by the LCA team and to publish results in peer-reviewed scientific journals. But there should be a simple structure without cumbersome reporting lines and vague responsibilities.

Response: See responses to comments NTRC-04 and NTRC-5.

***NTRC-43**:* There is concern among committee members that the organizational and staffing structure of the S&T office will not be adequate to manage the work load associated with ongoing and planned LCA activities. In particular, there is concern that there has not been a detailed discussion that identifies the range of tasks that would be assigned to the S & T office. For example, there is likely to be a need for staff to serve as liaisons between the S&T office and individual LCA projects. Experience among NTRC members suggests that several individuals, perhaps at the MS or Ph.D. level, will be required to handle these tasks efficiently and the number of individuals that will be required will increase as more and more LCA activities are initiated. Information Technology (web site, metadata development, QA & QC of data streams from individual projects, meeting federal requirements for reporting, etc.) should also be an important component of the S&T office to insure uniformity and communication across the entire LCA effort. This aspect of the S&T office needs to be discussed and appropriate planning developed to meet staffing needs. There may be other staffing needs that are not addressed in this commentary. The point to be made is that the S&T office needs to be designed and staffed to meet the needs of the LCA. NTRC committee members are concerned that the current concept of the office may under-appreciate its importance.

Response: Concur that staffing needs to be appropriate to the work requirements, but the plan does not specify staffing requirements in detail as future needs for the program are unforeseeable.

***NTRC-44**:* The Director of the S&T Office is a key person, who would not only be responsible for determining S&T priorities, peer review, contracting and reporting, but must also provide leadership for the incorporation of science and technology into the adaptively managed LCA program. Extraordinary skills, knowledge and experience will be required. Consequently, a broad search should be conducted to find the best person available regardless of present institutional affiliation.

Response: Comment noted.

4.2.2 Adaptive Management and the Comprehensive Plan

4.2.2.1 Emphasize Adaptive Management in the Main Report

***NTRC-45**:* In systems scale decision-making – such as that of the LCA - adaptive management is not separate from the overall decision-making process. It is different from traditional decision making in that the component parts (projects) will likely change over time; there may be greater engineering, scientific, political and other uncertainties; and total system costs may change rapidly and be highly speculative in the long-term. Thus there is a need for the incremental, experimental, learning approach of adaptive management. At the system scale adaptive management is not limited to post-construction monitoring and correcting project results, but includes the full range of decision making, from planning through operations, potentially over many years and iterations of decision making. It cannot be isolated in a single paragraph or appendix – it is the entire process over time. It cannot be limited to a percentage of a construction budget – it requires the entire budget.

Response: The LCA Study recognizes the importance of AEAM and appropriate funding would be provided to satisfy program objectives.

***NTRC-46**:* Therefore the placement of the adaptive management (AM) program discussion in the S&T appendix and then placing the AM program management solely in S&T Office needs to be revisited. More specifically, the blocks of text in 3.3.4, 2.1.1.2 and 3.3.1.1 (as well as some other text in the S&T appendix) needs to be brought forward to organize the presentation of the main report and to provide justification for the chosen near-term projects, the demonstration projects (the need for the knowledge they are expected to provide), the request for a programmatic authority, and the logic for the S&T program. In fact an S&T program cannot be justified except by making the case in the main report for organizing the whole of the LCA around an AM (continuing planning) process.

Response: See response to comment NTSC-10.

***NTRC-47**:* Some edits and ideas to consider when moving this text into the main report are suggested by the following recommendations with the associated comments:

A concise (but sufficiently detailed) description of overall decision support system needs to be in the first section of the main report and explained in a way that makes AM the centerpiece of that decision support system. The decision support system is the set of models that inform decision makers' choices on the design and implementation of a sequence of LCA projects in the face of technical, value and budgetary uncertainty. At the same time there needs to be a systematic means for reducing uncertainty over time, with the goal of improving the models that support future project planning and decision-making (see below).

The discussion of the decision support system in the main report should make clear that it would be developed to explicitly identify constraints and tradeoffs among new projects, existing and backlogged projects and other planning and regulatory decisions made that affect the flow of service from the working coast. Over time the scope and scale of the planning effort is to support informed decision making in recognition of the interdependencies among actions and the tradeoffs in outcomes affecting the recreational and commercial uses of the working coast. This is an analysis as well as a policy making challenge that must be acknowledged but the discussion of "consistency" in the current S&T plan is both inadequate to make this important point and is misplaced in the S&T appendix.

The main report should clarify that the decision support for the LCA will be accomplished through the development of the "systems synthesis model" (there is a discussion of such a model in the S&T draft). The basic features of that model, its utilization and its improvement through time should be described in the main report. A systems synthesis model should have the following features:

- Be able to rapidly simulate (predict) multiple outcomes of various combinations of alternatives.

- Because decision-making is expected to be a collaborative process, the desired contribution of the systems synthesis model to decision support requires that the assumptions, computational techniques, and the logic underlying model results are transparent to all relevant decision makers.

- Be at a different resolution than some existing models, but draw upon those models for its construction. In this sense the system-synthesis model cannot be built from the bottom up, but instead must be conceptualized and constructed "top-down."

- Be simple but not simplistic. By this is meant the system-synthesis model is for informing choices about general project, design, location and operations in relation to the goals and constraints of the LCA. This is not the model for day-to-day project operational decision-making or for making refinements in project design, and does not require the precision required for models with that intended use.

- Help identify and prioritize key scientific uncertainties and policy ambiguities in order to inform the design of demonstration projects and experiments that can help reduce uncertainties over time (see AM discussions below). In turn, the systems synthesis modeling team must have a clear process and capability to use what is learned in order to make model improvements over time.

Response: See responses to comments NTRC-12 and NTRC-13.

***NTRC-48**:* The model must be empirical, but where there are significant uncertainties in data or in relationships among variables in the model, best professional judgment or literature values may need to be employed. The representation of such judgments in a "Bayesian" framework would allow the model to be solved, the propagation of the uncertainty into the model prediction represented, and critical uncertainties identified as a way to target the adaptive management studies for model improvement for the next round of decision support. If a Bayesian approach is not adopted there should at least be attention paid to careful sensitivity analysis on those parameters and data sources characterized by high levels of uncertainty.

Response: The report has been clarified to ensure that systematic, rational decision making processes and modeling approaches are incorporated in the program.

***NTRC-49**:* A system syntheses modeling and planning "center of expertise" should be housed outside the S&T office in association with program management, while the responsibility for model development could be in the office of the S&T. There is a system synthesis modeling located at the interface of decision making although there is some reference to that concept in the S&T appendix. Include a dedicated budget and staff for the development and utilization of the system synthesis model. This is missing and the budget process seems to be driven by project specific budget accounts. (Note that the existing budget includes no such support). Page 29 in the S&T draft - the discussion of decision support - is really about education and outreach. This is not a clear depiction of the idea of empowered decision-making the locus of choice the integrative role of the model as negotiation facilitator.

Response: See response to NTRC-14. Budgets for the S&T Program are not specified in detail because of the need for flexibility. Budgets for other program elements are prepared year-to-year to execute the program.

***NTRC-50**:* The term “Adaptive Management” is insufficiently explained, is at times misleading, and AM discussion text should be edited to remedy these deficiencies. In the end AM is about learning, perhaps more than it is about adjusting a given project operation to meet a goal. Monitoring to see if a project “worked” is of no value unless there is a capacity to learn why it did or did not work. This logic for AM is missed in most places. AM is weakly defined in the text (for example, at page A3). The way it is described sounds like passive AM and is individual project focused. (See page A7 for another example). The cited AM literature is quite thin (I see only one reference). If only one reference is to be used one of the best is Anderson, J.L., Hilborn, R.W., Lackey, R.T., and Ludwig, D., Watershed restoration: Adaptive decision making in the face of uncertainty, in *Strategies for Restoring River Ecosystems: Sources of Variability*, Wissmar, R.C. and Bisson, P.A., Eds., American Fisheries Societies, Bethesda, MD, 2003. (A copy can be provided if necessary). Be clear that AM is about hypotheses testing for model improvement (more below). The discussion at 2.1.1.4 seems to miss the contribution of post-implementation monitoring to model improvement and seems to be about managing a specific project. There is a throw away paragraph at the end of the section that seems to acknowledge the importance of AM for model improvement, but it is not adequately emphasized.

Response: Concur. See responses to comments NTRC-10, NTRC-11 and NTRC-15.

***NTRC-51**:* The report should define the term “best science” in the context of the AM framework and the modeling required to build a better decision support system over time. The frequent reference to “best” science in the LCA report should be defined in terms of the process of knowledge creation over time and not (as is implied by the text) a set of “facts” taken from recognized experts. (See page A3 for example of this problem and as another example see page A5). In this regard, the report should distinguish clearly between science and modeling as a way to organize the logic of the S&T program and relate project selection to the AM concept. Science is the process of continuing inquiry organized around hypotheses testing. Modeling is the (usually) mathematical representation of a system using a set of assumptions about the relationships among variables of interest. Assumptions used in model construction are taken from accumulated hypotheses testing (conventional wisdom), specifically tested hypotheses or best professional judgment (BPJ). Decisions to pursue some actions must be made based on models, but there is a need to continually apply science as a process in order to examine the conventional knowledge and BPJ with tested hypotheses on the most critical model parameters. It is with this understanding that AM can be defined as part of the science needed to build better decision models. Learning while doing is what it means to bring science to the LCA, and AM is a central part of that learning. AM is not all there is to the learning (the S&T program is more than AM) and other forms of experimentation and literature syntheses are all a part of building better representations of the system (models) to support future rounds of decision making. It follows that the priorities for the S&T program must be set over time to serve the needs for reducing critical model uncertainties. The limited funds available for the S&T program must be prioritized in light of the decision support model needs.

Response: Concur. See response to comment NTRC-16.

NTRC-52*:* The text should be carefully edited to clarify the roles for monitoring in an AM planning framework, and within the S&T program. There are two roles for monitoring. Monitoring to measure goal achievement and monitoring to learn should be distinguished (page A27). Throughout the text the monitoring discussion is decoupled from modeling and learning (see page A3 and other places.) As a stark example, on page A6 how can components 1, 2, 3 and 5 be defined without reference to 4 (modeling needs)? On page A9 how can data gaps be defined if there is no model to organize the data needs and priorities? The discussion of the report card to measure success, described in the S&T draft, needs far more thought. First, the question for reporting is whether the report card for success is based on before and after, or with and without, baseline for defining success. This is not even addressed. Second, there is no recognition that there can be monitoring is a sampling problem and there are multiple sources for possible measurement uncertainty. There is a need to accommodate and recognize such uncertainty in any report card exercise.

Response: Concur. See response to comment NTRC-17. See additional discussion in **Appendix C – HYDRODYNAMIC AND ECOLOGICAL MODELING**.

4.2.2.2 Need for a New Conception of a Comprehensive Plan

NTRC-53*:* The LCA team process should be guided by a comprehensive plan that establishes a planning framework suited to the spatial and temporal scales of the LCA program. Such a plan is not a list of projects and is not only by or for the Corps. Instead the plan is a set of operational and measurable decision rules, performance standards and analytical processes that govern all public investment and regulatory decisions that affect the water and related land resources of coastal Louisiana. Such decisions extend beyond direct water resources programs and include programs such as transportation investment planning, agricultural policies, and local zoning. The Corps would cooperate in the development of the plan. A comprehensive plan precedes and is used to evaluate individual projects and regulatory decisions by the Corps and all other entities. The LCA team is operating in a policy and planning vacuum. The lack of practical guidance for system-scale studies continues to bedevil the LCA Study.

This problem is not unique to the LCA but is nationwide, and is further aggravated within the Corps by a variety of Corps-specific requirements such as:

Limits on monitoring and adaptive management (percent of construction costs) where adaptive management is actually the full iterative decision making process over a period of many years, as is the case for the LCA.

The need to identify and reach project close out, which does not yet appear to be a major problem for the LCA but will become more important as project construction gets underway.

The need for a definitive "total project cost", driven by the traditional needs of both the authorization and appropriations processes.

The need to conduct an incremental cost analysis to determine project priorities. Such analyses are useful at the project scale. However, such analyses may not make as much sense at the systems scale where making investments based on incremental costs and benefits may be trumped by, for example: (1) the need to fix truly critical problems first (2) issues of construction sequencing, (3) political equity among jurisdictions (among the four LCA subprovinces, for example), and (4) functional dependencies among projects.

Response: Noted. These issues address Congressional and Administration policy and guidance changes that are not within the authority of the USACE. See response to comment NTRC-18.

4.2.2.3 The LCA Team should develop its own internal guidance for future system-scale studies such as the LCA, addressing such issues as:

***NTRC-54*:** Corps system studies should be consistent with the comprehensive plan as described above.

Response: See response to comment NTRC-18.

NTRC-55*:* The need to consider relevant projects, programs and actions by all stakeholders throughout the system, including other Federal, State and local agencies, NGOs and private interests (including the oil industry in the case of the LCA).

Response: The relationships between these activities and organizations are explained in the discussion of consistency and coordination between development and coastal restoration and protection efforts in section 4 of the main report.

NTRC-56*:* The need to consider all types of agency programs, including planning, design, construction, operations, regulatory and grant programs.

Response: See response to comment NTRC-55.

NTRC-57*:* System-scale analytical requirements, such as alternative evaluation paradigms (with-and-without, before-and-after, gap analysis), scenario analysis, and premise set analysis.

Response: These elements of the LCA Plan will be addressed by the PM, with technical advice provided by the S&T Office.

NTRC-58*:* Clear links among decisions to be made, tools to be used to assist decision making, and data to be collected to support decisions.

Response: Responsibilities and organizational structure for these functions are described in the discussion of the S&T Office in section 4 of the Main Report as well as in Appendix A – SCIENCE & TECHNOLOGY PROGRAM

NTRC-59*:* System-scale technological support, including decision-support models that can trace effects of actions throughout the system.

Response: These issues are described in detail in Appendix A.

NTRC-60: Common metrics, including dollar values, which can be used for system-wide comparisons across individual projects, and across systems nationwide.

Response: These measurement requirements will be developed by the S&T Office.

NTRC-61: The basis for justification beyond National Economic Development (NED), to include environmental quality and social well being.

Response: Specific approaches to these issues will be developed by the S&T Office. In addition, these areas of concern will be addressed in project-specific NEPA compliance efforts.

NTRC-62: Authorization language models, including programmatic authorizations, critical projects, etc.

Response: These program elements are under consideration and discussion with the state.

NTRC-63: Federal coordination, including a requirement for a Federal Principals Groups meeting regularly to resolve interagency issues.

Response: These functions would be by the LCA Task Force, as described in the discussion of Plan Management in Section 4.

NTRC-64: Peer support and review, including use of NTRC-like groups throughout the course of decision-making.

Response: Peer review processes and requirements are described in detail in Appendix A, and are also to be used to support the Program Execution Team.

4.2.3 Near-term Critical Restoration Features

NTRC-65*:* The directive to select a few specific projects to be authorized for short-term implementation has provided some difficult constraints in developing a comprehensive approach to LCA restoration. Given those constraints, the decision process and associated screening criteria represent a reasonable approach to identifying near-term critical restoration features that are important elements of a more comprehensive framework, provide learning opportunities consistent with adaptive management and could feasibly be completed within ten years.

Response: Comment noted.

NTRC-66*:* Information in the Main Report does not adequately describe projects to support decision-making without prior knowledge or access to references. In addition, justification for project selection is weak or unclear; the appearance is that some projects were chosen for reasons other than those supported by LCA Plan goals and then rationalized.

Response: Concur. The descriptions of features and the explanation of the plan formulation process have been revised.

NTRC-67*:* The goals and objectives of the LCA Plan seem to wander between land gain (for example, the beneficial use of dredged material is justified by land gain) and increased AAHUs (most projects are justified by increased AAHUs), with protection of infrastructure or protection of existing wetlands often mentioned. None of the putative benefits appear to be measurable in a repeatable manner (that is, success cannot be clearly measured). This is a major problem with the LCA Plan, in that it indicates a lack of clear direction. Also, suggesting cost per AAHU ("an average annualized cost of $2,600 per unit provided," page viii) when AAHU cannot be consistently measured is misleading. Lastly, it is difficult to see how the projects fit within a comprehensive plan (i.e., how do the projects relate to one another).

Response: The basis for project selection has been revised through clarification of the plan formulation process, including the critical needs criteria, rules for project sequencing, and the resource and implementation constraints and assumptions that were used in plan formulation.

4.2.3.1 Mississippi River-Gulf Outlet (MRGO) environmental restoration features

NTRC-68: This restoration feature has received the most public criticism of the five proposed for near-term implementation. There is broad concern that the MRGO has been and continues to be environmentally harmful and its maintenance and use for deep-draft navigation should be discontinued. On the other hand, the case is made in the LCA Main Report that these features meet the screening criteria, specifically because this project was included in the selected Subprovince 1 framework and aims to prevent significant wetland loss that is imminently at risk.

The case for the MRGO environmental restoration features is considerably weakened by the failure of the Report to address in a forthright way the decision process and timeframe in which the future of the MRGO will be determined. This leads, with some justification, to the suspicion that stabilization of the existing land features, at a minimum puts off decisions regarding the fate of MRGO. The descriptions on pages MR 161-163 should include statements on how undertaking these features will factor into decisions on the use of MRGO for navigation and the long-term management options for the channel and associated dredged material banks. The brief statement in Section 1.6.2.3 that the Corps is undertaking a study to consider management options is inadequate and too far removed from the discussion of the proposed restoration features to be useful.

Response: See response to comment NTRC-19.

4.2.3.2 Small Diversion at Hope Canal

NTRC-69: Regeneration of cypress-tupelo forests generally requires periodic flooding and dry down and without dry down the forest is ultimately doomed. While freshwater diversion may increase productivity, there is a need to demonstrate that productivity and mineral sediment addition will increase sufficiently to increase (or stabilize) elevations. Unless it can be demonstrated that the diversion will deliver enough sediment or promote productivity yielding habitat that dries periodically, the project should reexamined. A long-term management plan for the swamp should be developed in conjunction with the project. The plan suggests that 36,000 acres of swamp will be “enhanced,” but enhancement is not defined. Cost per AAHU is $8,239, three times higher than the average claimed in the report’s introduction, and the high cost needs to be justified.

Response: The overall setting, ecosystem dynamics and specific operational parameters and requirements for each restoration feature will be evaluated and developed through the detailed analyses necessary to prepare feasibility-level decision documents for each project. All benefit analyses results presented in the draft report have been verified and revised, where necessary.

4.2.3.3 Barataria Basin Barrier Shoreline Restoration: Caminada Headland and Shell Island Reaches

NTRC-70: These two features are united by virtue of serving the common objective of preserving the physical integrity of the lower boundary of the Barataria Basin. In that sense they are an integral part of the restoration framework for Subprovince 2. The physical boundary along the Caminada Headland is less immediately threatened than along the Shell Island reaches, which are already largely breached. In that sense it is less immediately critical from the basin perspective. On the other hand, it is argued that restoration of the Caminada Headland is a near-term critical priority because important habitats (maritime forests, black mangroves) and the land bridge leading to Caminada Pass are threatened. Furthermore, the existing technology and operational capabilities allow this project to be implemented within ten years, thereby meeting a key sorting criterion. The Shell Island reaches restoration involves strengthening remnant barriers and also reconstituting them using structures to contain sediment fill.

These two features show that both ecological restoration and infrastructure protection can be simultaneously achieved; this point should be emphasized. The project as proposed will require maintenance in perpetuity; while this may be an acceptable option, the need for perpetual maintenance should be acknowledged and innovative methods should be developed to control costs of ongoing maintenance. Among these innovative methods, there may be opportunities to develop and apply dredging technologies that rely on alternative energy sources (e.g., this may be an opportunity for fuel-cell power plants). The plan claims that this work may restore the oyster fishery in Bastian Bay, but if so it should be recognized that if the oyster fishery is restored its presence may limit future coastal restoration options. The plan calls for pumping of sediment "from interior open-water sites" (page MR-167); it is not known how removal of sediment from interior open-water sites will impact interior marshes, but it seems likely that this process could accelerate interior land loss and/or decrease habitat value (and AAHUs) of interior open-water sites and associated marshes. Shoreline armoring of some kind likely will be required, and the project's flexibility in using different approaches to armoring (rather than relying on rip rap) will contribute to a better understanding of cost effective methods of armoring. The annualized cost per HU is $17,901, 6.8 times higher than the average claimed in the report's introduction, and the high cost needs to be justified.

Response: See response to comment NTRC-21. Specific alternatives for feature elements, such as different approaches to shoreline armoring, will be evaluated during the studies needed to produce feasibility-level decision documents. All benefit analyses results presented in the draft report have been verified and revised, where necessary.

4.2.3.4 Small Bayou Lafourche Reintroduction

NTRC-71: The proposed Bayou Lafourche feature represents a good example of leveraging efforts under CWPPRA to advance the goals of the LCA Ecosystem Restoration Study. However, several key components of the feature are omitted and, therefore make assessment more difficult. The narrative lacks information about the proposed quantity of water that constitutes what a "small" reintroduction represents. It is also uncertain where water will be distributed from the bayou and, therefore the transport distance for sediments. Velocities necessary to transport sediments are not described. No plan for maintenance dredging of the channel is described or accounted for in the budget.

There is no information about how the added water volumes will be handled. If the feature will rely on existing channel geometry, then the feature would likely cause flooding to nearby infrastructure unless very small reintroductions are provided. If the plan is to deepen the channel to increase capacity, then questions about potential sediment quality removed from the channel and disposal should be addressed. It is also possible that deepening the channel could induce saltwater intrusion farther upstream and create other problems. The document states that just the opposite will occur and those saltwater levels will be reduced upstream. This prediction seems to be based on the increased velocities anticipated by the reintroduction, but no information on velocities is provided.

There are also several concerns about the assumed benefits of the feature. Stating that the sediments will sustain about 5,250 acres of brackish marsh seems very optimistic since it is based on the assumption that 100% of the clay sediments would be retained uniformly across the marsh surface. It is very unlikely that transport will be that efficient. A similar concern is expressed for the assumption that 100% of the nitrogen could also be transferred to marsh environments and double marsh biomass, both seem very optimistic.

Although there is limited information to comprehensively assess the effectiveness of this proposed feature, the general plan appears to have potentially substantial merit and should be carefully pursued because it would lead to understanding of options for the use of Bayou Lafourche as a conduit of river water and supplying freshwater into an area with no other sources. Issues about the volumes of sediments that will effectively reach adjacent marshes should be more accurately calculated and anticipated nitrate levels within the reintroduced water and the effect nitrates will have on biomass production should be determined. This information and other lessons learned from this project could also be relevant for other potential features and could therefore also provide additional benefits.

Response: See response to comment NTRC-22.

4.2.3.5 Medium Diversion with Dedicated Dredging at Myrtle Grove

***NTRC-72**:* This feature offers excellent opportunities for both significant benefits to Subprovince 2 and learning how to manage dredged material and river diversions in tandem. The potential for experimental approaches and small-scale, pilot subprojects is great and should be maximally exploited. Building on the ongoing CWPPRA feasibility study affords a "value added" opportunity for the LCA Plan rather than starting from scratch. Integration of this diversion with the Davis Pond reintroduction and, potentially, the small reintroduction through Bayou Lafourche can be accomplished using existing and evolving hydrodynamic and eco-geomorphic models.

Response: See response to comment NTRC-23.

4.2.4 Science and Technology Program Demonstration Projects

***NTRC-73**:* This is a very important component of the LCA Plan because it provides the opportunity for large-scale experiments to rapidly improve learning in an adaptive management context. The challenge, however, is to provide sufficient flexibility to pursue strategic challenges to reduce uncertainty. In that regard, we are concerned that the five demonstration projects identified suggests that those five are the most critical demonstration projects for narrowing uncertainties and preclude addressing other topics that are not included in the present list. While it is understood that it is necessary to identify specific demonstration projects to illustrate issues to be tested, it is important that sufficient flexibility be included to substitute different objectives during management of the program.

Response: Comment noted. See response to comment NTRC-25.

4.2.4.1 Marsh Restoration and/or Creation Using Saline Sediments

NTRC-74: This section needs to be reconsidered and revised. This project, as described, will do little to advance knowledge about use of marine sediments to create wetlands because many salt, brackish, and fresh marshes in Louisiana and Texas have been created using marine sediments. Rainfall in coastal Louisiana is more than adequate to rapidly leach salts from sediment. There may be circumstances in which leached salts could have short-term impacts on surrounding ecosystems, but past experience should be adequate to determine the significance of this problem. Development of methods to effectively and consistently use fine sediments (marine or fresh sediments typically from maintenance dredging in low-flow channels) and to use sediments with low-level contamination would be more useful than investigating use of marine sediments. It is unclear how thin placement of sprayed dredged material could be used to move marine sediments to freshwater habitats (usually, thin placement involves spraying sediment directly from a barge involved in channel construction or maintenance onto the adjacent marsh). Also, it is difficult to see why any dredged material project would have to be justified as a separate demonstration project when several other projects incorporate use of dredged material and while many Beneficial Use of Dredged Material projects will proceed under Section 204 authority. Lastly, construction of four 200-acre cells would not provide meaningful replication that would advance the understanding of dredged material wetland construction.

Response: See response to comment NTRC-25.

4.2.4.2 Land Bridge Restoration Using Long-Distance Conveyance of Sediments

NTRC-75: Demonstration projects are designed to resolve critical areas of scientific, technical, or engineering uncertainty while providing meaningful restoration benefits. Long-distance pipeline conveyance of dredged material has potential application in many areas of the coastal environments. The demonstration could be tested in many different locations under a wide variety of habitats from deep-water areas to those with shallow broken marsh. Different types of uncertainty could be addressed. It is unclear why the land bridge was chosen as the particular area to demonstrate and evaluate this technology. However, it is wise to test the technology in a critical area where potential benefits could be maximized.

Response: See response to comment NTRC-26.

4.2.4.3 Pipeline Canal Restoration Using Different Methods

***NTRC-76*:** This section needs to be revised to take advantage of and build upon past work (by Turner, Reed, and others) on backfilling of pipeline canals. The project should focus in part on identifying abandoned canals that would be suitable for restoration and on developing a cost effective means of restoration. Canal restoration in areas associated with other restoration projects (e.g., downstream from freshwater and sediment diversions) should take priority.

Gapping or breaching spoil banks (sometimes called "spoil bank management") should be treated separately from restoration of canals in that spoil banks can be gapped around canals that are still in use (and that are therefore not suitable candidates for restoration). Cost estimates for this work are not justified by the project description.

Response: See response to comment NTRC-27.

4.2.4.4 Shoreline Erosion Prevention Using Different Methods

***NTRC-77*:** This work should be integrated with other planned projects that require use of shoreline armoring. The section should be rewritten to specify different methods of shoreline protection, such as geotextile tubes on shorelines, geotextile tubes placed as wave trips, geotextile tubes filled with grout (to provide more permanent protection than that provided by sand-filled tubes), use of geofabric and cocomat, use of cultivated oyster shell reefs for shoreline protection, and use of minimal efforts for shoreline protection (that is, efforts that assess how well shoreline protection methods using small amounts of rip rap or other armor perform, to test whether or not current approaches to shoreline armoring are overbuilt).

Response: See response to comment NTRC-28.

4.2.4.5 Barrier Island Restoration Using Offshore Sources of Sediment

***NTRC-78**:* It is not clear that full-scale demonstration projects are required to reduce key uncertainties. For example, the quality of offshore sand resources can be determined through acoustic surveys, vibrocoring, etc. and suitability assessed through known performance criteria. There may remain some uncertainties regarding the engineering feasibility of conveyance, but this could also be determined without a costly demonstration project.

Response: Comment noted. See response to comment NTRC-29.

4.2.5 Programmatic Authority for the Beneficial Use of Dredged Material

***NTRC-79**:* This portion of the Plan is very sensible. Placement of dredged material through the Section 204 authorization should be integrated with other LCA Plan projects whenever possible. Part of the Section 204 funds should be used to develop methods to beneficially use fine sediments. Part of the Section 204 funds should be used to further develop thin-layer placement that could restore subsiding but still vegetated marshes (i.e., use of spray dredging). Also, development of low-cost, energy efficient, and/or alternative energy powered dredging should be pursued. This section provides an estimate of land gain (21,000 acres) but does not give benefits in terms of AAHUs. Also, note that this section suggests that all created acreage will be wetlands, but in fact at least some created acreage is likely to be (or could be) upland habitat.

Response: Comment noted.

4.2.6 Programmatic Authority for Modifications to Existing Structures

***NTRC-80**:* Similarly, this programmatic authority would offer great advantages for using existing capabilities to maximize restoration outcomes. A recent National Research Council report on adaptive management for water resources management specifically recommends such modifications of navigational and water management infrastructure to address changing management objectives. This programmatic authority is very consistent with this recommendation.

Response: Comment noted.

4.2.7 Near-term Critical Restoration Features Recommended for Standard Process of Implementation

***NTRC-81**:* Because the LCA Plan does not request programmatic authority for these projects no detail is provided. Therefore, the NTRC is unable to provide specific comments or evaluation of priorities among the ten features listed. There should be flexibility regarding the addition and substitution of projects as comprehensive planning and evaluation proceeds.

Response: The plan formulation section of the Main Report has been revised to clarify the processes that were used to evaluate the restoration frameworks and the methods used to determine project outputs and perform cost-benefit analyses of individual restoration features.

4.2.8 Large-scale and Long-term Concepts Requiring Detailed Study

***NTRC-82**:* This portion of the LCA plan encompassed only a single paragraph in which it is recognized that some projects have *"significant potential to contribute to achieving restoration objectives"* within a subprovince, between adjacent subprovinces, or across the entire coastal ecosystem. NTRC members have previously commented on the importance of large-scale projects. They have recognized that these projects are difficult to design and implement and that a high degree of uncertainty is associated with them. On the other hand, if restoration of the entire coastal system is to be successfully accomplished the effort will need to include large-scale projects that impact significant portions of the coast. Success of the entire project seems unlikely if it consists of projects of relatively small scale that have not been planned to provide synergistic effects at larger scale.

Given the relatively small scale of the projects in the current LCA plan, NTRC members want to again emphasize that future efforts need to continuously evaluate and update projects that fall into the category of long-term and large-scale. These types of projects need to be included in the programs that are discussed and developed within the Science and Technology Program. It would be particularly useful to identify uncertainties in each of the large-scale and long-term projects cited in the Plan (**Table MR-20b**) so that direction and guidelines can be developed to move them forward within the planning process. In addition, consideration needs to be given to the relationships between the proposed large-scale and long-term projects and smaller scale and shorter-term projects that are planned and implemented. Each small-scale and short-term project needs to be considered in the context of how it would benefit planning for long-term and large-scale projects. An example of this type of connectivity can be found in the description of the benefits of the Small Bayou Lafourche Reintroduction (Page MR-172).

Five potentially promising large-scale restoration concepts are included in the July 2004 Draft LCA Study (Main Report): 1) Mississippi River Delta Management Study, 2) Third Delta Study, 3) Upper Atchafalaya Basin Study, 4) Chenier Plain Freshwater Management and Allocation Reassessment Study, and 5) Acadiana Bay Estuarine Restoration Study. The report states that upon completion of detailed feasibility studies, recommendations for action would follow in the same manner as other features not qualifying for programmatic authority, including the standard review and authorization process. One of these restoration concepts, the third delta, has already been studied (Gagliano and van Beek, 1999), and the Louisiana DNR is involved in a follow-up reconnaissance study (target completion by December, 2004) to evaluate feasibility. The LCA Plan recognizes that a fundamental area of controversy is whether more attention should be given to comprehensive, long-term restoration efforts as opposed to near-term efforts.

Each of the five identified large-scale restoration concepts failed the first sorting criterion, *"engineering and design be completed and construction begun within 5-10 years",* and were thus relegated to the category *"possible large-scale study"*. The chief concern, expressed initially at the April, 2004 NTRC Meeting, is whether these potentially important components of the comprehensive restoration plan will disappear from the radar screen altogether. Have these studies been dumped into what appears as a trash bin to remain thereafter as an afterthought, either too hard to tackle or too far in the future to possibly implement? The answer to this question appears mixed. On the positive side, they continue to appear in Plan Formulation in the PBMO (Plan that Best Meets the Objectives) and in Plan Implementation under Assumptions and Rules, and are embedded in the TSP. Moreover, they appear in **Table 21c** (TSP Implementation Alternative) with early start dates that range from 10/04-10/06 and early finish dates that range from 04/07 to 09/10.

There is concern, however, in that it is not clear what type of studies will be formulated and conducted. The Plan calls for feasibility studies, but there is a certain open-ended aspect to the brief discussion of these studies given that most of the report is focused on near-term projects. What happens after the studies? Is there a well-defined mechanism to move the study outcomes, if warranted, to the authorization level? If so, how? Also of moderate concern is that in the cost sharing distribution in **Table MR-23** the total amount for long-term studies is $60 million, which represents only 3% of total budget for LCA TSP Cost. This is a very modest sum if the intent is to fully explore these five concepts. The S&T Program appears heavily vested, as it probably should be, in implementing near-term projects, establishing performance measures, ensuring principles of adaptive management are applied, and developing better analytical tools. Whereas programmatic authority in the S&T Program is explicitly identified for demonstration projects and for beneficial use of dredged material, no analogous authority is discussed for long-term studies, although one must assume that it is implicit in the S&T Program's charge. In short, it is not clear how momentum will be generated to keep the long-term studies alive as viable options, and we specifically recommend that this be addressed more fully in the LCA Plan Implementation.

Response: See responses to comments NTRC-31, NTRC-32 and NTRC-33.

4.2.8.1 Mississippi River Hydrodynamic Model

***NTRC-83**:* Water and sediment continuity is critical for the physical stability of streams and rivers. Continuity is defined as a balance in the amount of water and sediment entering and exiting a stream reach. Continuity throughout the entire system and the effect of changing existing balances on coastal marshes, river infrastructure and associated uses must be evaluated. The Mississippi River Hydrodynamic Model should be entitled *Mississippi and Atchafalaya Rivers Hydrodynamic and Sediment Impact Assessment Model* so that appropriate consideration is given to the two most significant hydrologic flows into the coastal systems. The study should specifically include:

- A study of sediment supplied from Mississippi and Red Rivers and from local sources along the channels;
- Study of transport capacities of the channels and diversions;
- Study of sediment sinks, existing or planned.
- Study of nutrient interactions with sediments and hydrology because of the importance of nutrient transport, uptake, storage, and cycling in coastal systems. Particular attention should focus on nitrogen.
- Presently, the Mississippi River Hydrodynamic Model is divided into three studies: 1) Mississippi River Delta Management Study, 2) Third Delta Study, Upper Atchafalaya Basin Study. From an engineering viewpoint, separation of the hydrodynamics and sediment assessment of the Mississippi system into three studies has little basis. Dividing a system by

imposed project boundaries only complicates the overall project and jeopardizes validity of study results.

Response: See response to comment NTRC-34.

4.2.8.2 Chenier Plain Freshwater Management and Allocation Reassessment Study

***NTRC-84**:* At previous meetings, members of the NTRC have commented on issues related to restoration in the Chenier Plain. Members have repeatedly commented that the goals and objectives of previously proposed projects in that subprovince are not conceptually sound within the overall concepts developed for the LCA. Committee members are pleased, however, that efforts within the subprovince have been included in the list of 'Large-scale and Long-term Concepts'. Committee members want to again state that the efforts developed for the subprovince to date have primarily considered water management options that do not reflect an appropriately broad approach. Members again want to recommend that this subprovince must be elevated to the status of the other three subprovinces in terms of innovation, commitment and approach and that planning needs to shift from a primary emphasis on water management to projects that take advantage of nearshore sediments and natural dispersal processes to reverse the pattern of wetland loss.

Response: Comment noted. Also see response to comment NTRC-35.

4.2.8.3 Acadiana Bay Estuarine Restoration Study

***NTRC-85**:* NTRC members are not clear on the goals of this effort, but based on information available at the time of our meeting it does not appear that this effort reaches the scale and importance of the other large-scale and long-term projects listed. Committee members are particularly concerned that efforts to alter hydrology in this area do not have a negative impact on the ongoing growth of wetlands in the lower Atchafalaya basin.

Response: Descriptions of all long-term and large-scale studies have been revised. See also response to comment NTRC-36.

4.2.8.4 Description of the Causes of Land Loss in the LCA Report

NTRC-86: The description of the causes of land loss in the LCA report did not reflect earlier comments by NTRC members. We provided the Corps with a document on causes of land loss, which it is felt is better than the existing section in the report. We suggest that the following section either replace the land loss section in the report or be used to improve it.

4.2.8.5 Factors Affecting Wetland Loss in Louisiana

It is natural to wonder what or who is responsible for the crisis occurring in Louisiana's wetlands, and there have been many attempts to allocate blame to various sources. The two factors most often cited as leading to land loss are construction of levees on the Mississippi River and the internal disruption of hydrology caused by construction of canals, but sea level rise, construction of dams, introduction of nutria, and other causes also have been cited. In reality, the crisis is the result of many factors interacting among themselves and with complex deltaic processes. While it may be possible to assign blame at some specific locations, it is difficult to assign blame for wetland loss on a broad scale. Understanding why this is so requires an understanding of the difference between direct and indirect causes of wetland loss and at least a basic understanding of the factors leading to land growth and land loss. Also it is necessary to understand how the natural system functioned and how human activities affected this functioning. In essence, there was net delta growth over the past several thousand years because the forces leading to delta growth were greater than forces leading to delta deterioration. Human activity has reduced the forces leading to delta growth and enhanced the forces leading to delta deterioration.

The Mississippi Delta formed over the past 6,000-7,000 years as a series of overlapping delta lobes (Roberts 1997). There was an increase in wetland area in active deltaic lobes and wetland loss in abandoned lobes, but there has been an overall net increase in the area of wetlands over the past several thousand years.

With the exception of the first delta lobe (Maringouin), significant parts of all subsequent delta lobes have been incorporated into the current delta as a system of overlapping and interwoven distributary systems. Overbank flooding, crevasse splays, and reworking of sands have formed a skeletal framework of these natural levee ridges and barrier islands within which the delta plain has formed (Kesel 1989, Kesel et al. 1992). Ecosystem functioning and sustainability of the delta is controlled by interactions of the Mississippi River and marine processes (Day et al. 1997). The skeletal framework protected wetlands of the deltaic plain from erosion and salinity intrusion and slowed interactions between fresh water and salt water parts of the delta. A number of processes were important in the formation and maintenance of the delta. Until modified by human activity, many of the distributaries continued functioning, delivering river water to large areas of the delta plain. Fresh water forms a buffer against salinity intrusion, and provides mineral sediments, nutrients, and other components, such as iron, that sustain healthier more productive wetlands. The distributary network was very efficient in sediment retention and about 25% of sediment flux was retained in the delta (Kesel). Because of the widespread freshwater input and the protection afforded by the skeletal network, floating marsh developed into a common marsh type. An important mechanism is the formation and maintenance of the delta was the formation of crevasses (Davis 2000). Crevasse splays occur where overbank flow becomes concentrated in a well-defined channel with enough scour capacity to erode permanent or semipermanent breaks in the levee. Deposition of both coarse and fine-grained sediments occur in crevasse spalys. Davis (2000) has documented hundreds of crevasses since European colonization began and it is clear that crevasses were an important element in the evolution of the delta.

With this brief introduction, we will now discuss direct and indirect losses in the context of the ecosystem functioning discussed above.

4.2.8.6 Direct and Indirect Losses

In many areas of the United States, wetland losses occur primarily because of direct causes: people drain or fill wetlands to improve their suitability for development, and those filling or draining the wetlands are clearly responsible for the wetland loss. While direct losses occur in Louisiana, the vast majority of losses in the state are caused indirectly.

To understand indirect losses, it is important to understand, as stated above, that land formation in coastal Louisiana is driven by a combination of direct deposition of riverine sediments, deposition of resuspended sediments, and organic soil formation from plant growth. Since sea level stabilized 5,000–7,000 years ago, after the last glaciation, the Mississippi River has carried sediments and water from its watershed to the coast of what is now Louisiana. Both the sediments and the water (including dissolved nutrients and freshwater) are important to land growth. Sediments carried by the river were mostly deposited near the mouth of the river to form extensive areas of land, known as delta lobes. Water delivered by the river provided nutrients that enhanced plant growth and prevented intrusion of saltwater, which hindered growth of many coastal wetland plant species. As plants grow, root growth increases the elevation of the land directly, by taking up space in the soil, and indirectly, by acting as a sponge that holds water in the soil. Simultaneously, as plants age leaves and stems fall onto the ground; in anaerobic wetland environments, decomposition is slow, and dead plant tissue accumulates, further increasing elevation by taking up space and by holding water. This process is called organic soil formation. Also, plants trap and retain sediment that originated from the Mississippi River. While sediment input and plant growth contribute to increasing elevation, delta soils are constantly subsiding, or shrinking, because of compaction and dewatering. Soil subsidence has always occurred in coastal Louisiana and it continues to occur at rates similar to those of the past (about 10 mm/y) in many areas. When sediment deposition and organic soil formation via plant growth offset subsidence, new land forms and existing wetlands are sustained.

In the natural course of events, delta lobes grow progressively larger and delivery channels longer, ultimately causing the river to adopt a shorter and therefore steeper route to the sea and leading to formation of a new delta lobe in a process known as delta switching. When the river or one of its distributaries abandons a delta lobe, subsidence leads to land loss. Delta lobes, or the remains of delta lobes, can be seen today in maps of Louisiana (Figure --). There have been large gains and losses of land in specific locations as the Mississippi River changed course over the past millenia, but the region as a whole experienced net land growth until human activities altered riverine and coastal processes, mainly in the last century. Because of human activities, factors causing wetland growth have been hindered and those causing wetland loss have remained steady or increased, and southern Louisiana's land area has shrunk dramatically. These human activities are the indirect causes of land loss in Louisiana.

Response: Comment noted

4.2.8.7 Human Activities with a Significant Effect on Land Loss

***Comment*:** Human activities that appear to have the most significant effect on land loss include (1) construction and management of levees and flood control structures on the Mississippi River, and (2) construction of canals and spoil banks that disrupt the internal hydrology of the delta. Other activities that may have a substantial effect on land loss include (3) burning of fossil fuels, which led to increased rates of true (or eustatic) sealevel rise, (4) removal of oil and natural gas, which may have resulted in accelerated down faulting, and thus increased subsidence, and (5) increased boat traffic and increased use of shipping channels, which increases erosion. Additional activities that may have relatively minor or localized effects on land loss include the introduction of nutria that graze extensively on wetland plants and construction of dams that trap sediment in the Mississippi River. Ignoring any one of these factors will prevent a full understanding of land loss.

Construction and management of levees and flood control structures: Beginning soon after European settlement, humans began to modify the river. Levees built to limit flooding of populated areas and agricultural areas also prevented overbank flooding and crevass formation, both of which delivered water and sediment into marshes and shallow coastal areas. Many distributaries were closed—today, only two remain (the main channel of the Mississippi River and the Atchafalaya River). Construction of levees, and, in particular, construction and management of the Old River Control Structure, which prevents the river from changing course and forming a new lobe that would extend outward from Morgan City, Louisiana, has temporarily ended delta switching. The river, unable to change course, has extended far into the Gulf of Mexico, and most sediments from the river that would have once formed land are now lost to deep water. In addition, construction of levees and control of the river affect plant growth by preventing the flow of freshwater and nutrients into existing wetlands. Control of the Mississippi River is perhaps the most important factor influencing land loss.

Construction of canals that disrupt the internal hydrology of the delta: There have been large-scale changes in the hydrology of the delta due to the construction of canals and associated spoil banks and the formation of impoundments. By the end of the 20th century, over 15,000 km of canals had been dredged in support of navigation, drainage, and oil-and-gas development. Canals alter natural hydrology in two main ways. First, canals that stretch from the Gulf inland to freshwater areas have caused significant saltwater intrusion and death of freshwater wetlands. Second, spoil banks associated with canals reduce the flow of water across wetlands, which is extremely important in controlling biogeochemical and ecological processes, including chemical transformations, sediment transport, vegetation health, and migration of organisms. Because of the presence of spoil banks, partially-impounded areas have fewer but longer periods of flooding and reduced water exchange when compared to unimpounded marshes. This results in increased waterlogging and subsequent plant death. Importantly, spoil banks also block the movement of sediments resuspended in storms, which play a significant role in sustaining land elevations. Like control of the Mississippi River, construction of canals is an important factor influencing land loss.

Eustatic sea level rise: True, or eustatic, sea level rise occurs with respect to absolute bench marks, as opposed to relative sea level rise, which occurs with respect to bench marks established on land surfaces that may be sinking. Thus, relative sea level rise includes both true sea level rise and decreases in land elevation from subsidence. Burning of fossil fuels is generally believed to lead to global warming. As the world's oceans grow warmer, water previously held in ice caps increases the volume of the world's ocean. Also, even slight warming increases the volume of liquid water in the world's oceans. During the twentieth century, eustatic sea level rise occurred at a rate of 1–2 mm per year, increasing the amount of coastal land that is submerged and the duration of flooding. Eustatic sea level rise is generally seen as a pervasive but relatively minor cause of land loss, but it is likely to become a more important cause if global warming models are correct.

Removal of oil and natural gas: Recent evidence suggests withdrawal of oil and natural gas may have lowered pressures in underlying geologic features sufficiently to allow increased down faulting, potentially tripling subsidence rates in large areas. Within the scientific community, discussions of the significance of removal of oil and natural gas as a cause of down faulting and subsequent land loss are in their infancy, but currently it is reasonable to believe that oil and gas removal has played a role in land loss via increased subsidence.

Increased erosion associated with waves, boat traffic, and increased use of shipping channels: Wave erosion along exposed shorelines is also a cause of wetland loss. Although erosion is not a major process in interior marshes, it has caused large losses along shores of lakes and bays and along barrier islands. The rate of shoreline erosion is often high during hurricanes, especially in floating marshes; this is thought to be partially responsible for the high rates of land loss in the modern birdfoot delta. Since 1990, wave erosion has caused an increasing proportion of land loss. Human activities that increase wave actions in marshes contribute to accelerated losses by erosion. These activities include construction of canals and navigation channels that increase fetch and allow generation of larger wind-driven waves, as well as operation of vessels that generate wakes.

4.3 SUMMARY

Direct losses can be quantified and attributed to specific causes with reasonable accuracy. Since the 1970s, direct losses have been dealt with through a permitting program required by Section 404 of the Clean Water Act as well as state laws. Indirect losses, on the other hand, cannot be attributed to specific causes with any degree of accuracy. The difficulty that prevents assignment of blame for indirect wetland loss—that is, for most of Louisiana's wetland loss—is related to the complexity of deltaic processes and the complex way that the Mississippi River and the Louisiana coastal zone have been altered. In other words, the losses result from numerous causes, any of which, alone, may not have resulted in the serious crisis confronting us today. Some of the causes of wetland loss—causes such as the introduction of nutria and construction of dams in the Mississippi River drainage—are relatively unimportant. Others—such as constraining the Mississippi River and construction of canals, are clearly more important, but neither of these acting in isolation would have resulted in the situation that exists today. Even partitioning blame to various causes—assigning a percentage estimate to various causes—is not straightforward, in that losses caused by specific kinds of activities cannot simply be added to yield total losses; instead, the interactions between causes must be considered. In summary, net wetland loss resulted because human activities reduced factors leading to delta growth and increased factors leading to wetland loss, but because these factors are interrelated, looking at any one of these factors in isolation will prevent a full understanding of the balance between land gain and land loss.

Response: Comment noted, however the existing language on natural processes and the causes of land loss was accepted by the Vertical Team.